VOL. XLVIII, NUMBER 6 WHOLE NUMBER 411

THE JOURNAL
OF
THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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PUBLISHED BI-MONTHLY
(*Six numbers per year*)

November-December, 1954

PRINTED FOR THE SOCIETY

TORONTO: 13 ROSS ST.

The Royal Astronomical Society of Canada

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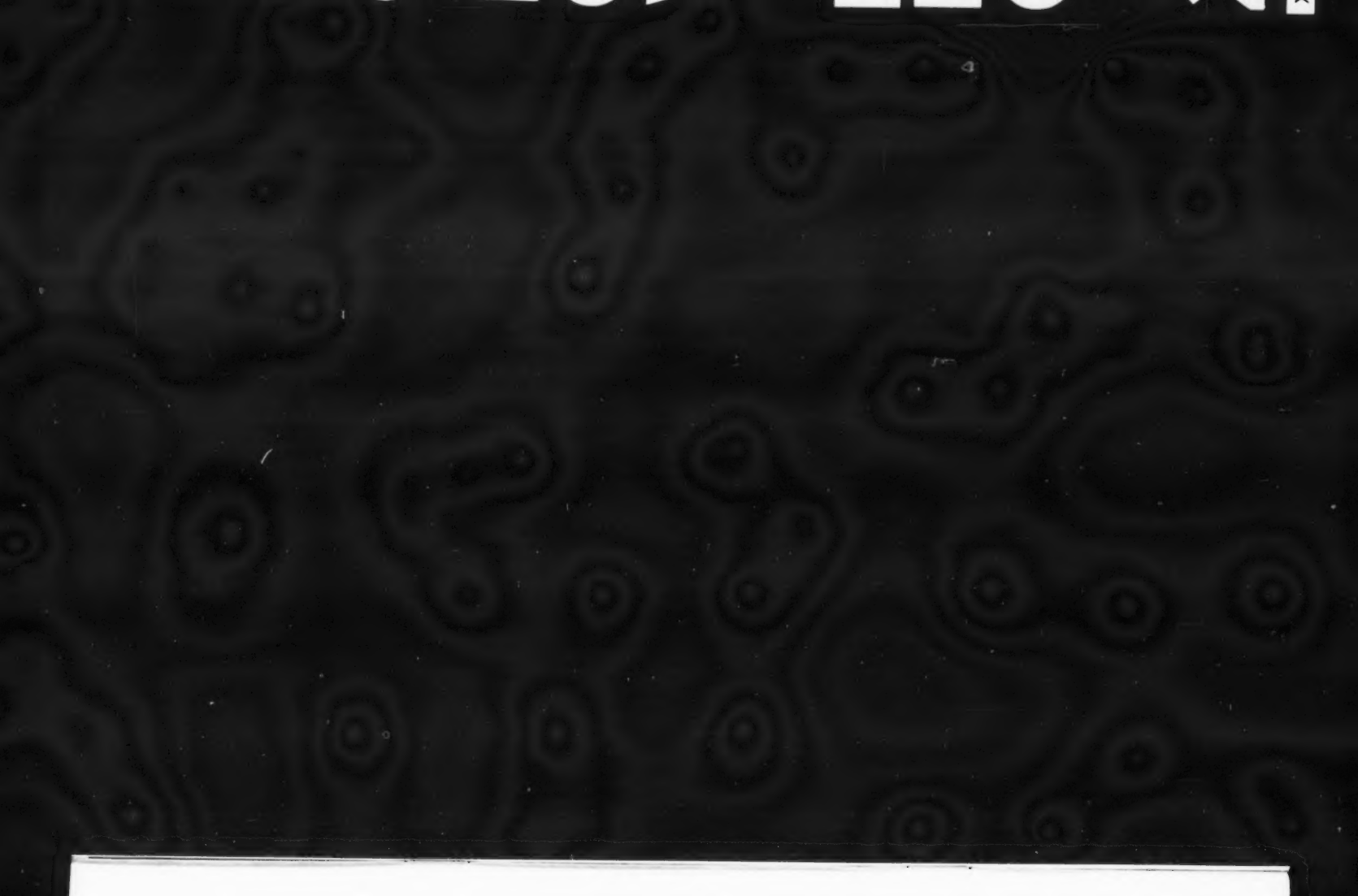

THE JOURNAL
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OF CANADA

VOL. XLVIII No. 6 NOVEMBER-DECEMBER, 1954 WHOLE No. 411

A TOTAL SOLAR ECLIPSE SEEN FROM ABOVE A BANK OF CLOUDS

BY F. J. M. STRATTON*

THE writer has had considerable experience with eclipse observations from below banks of clouds. These, being made before the development of radio-astronomy, were limited to watching the dark shadow sweeping across the landscape—though other observers were making records of temperature, atmospheric electricity, the magnetic field or atmospheric winds. On the occasion of the total solar eclipse of June 30, 1954, by the kind invitation of Sir Miles Thomas, Chairman of the B. O. A. C., an opportunity was given of observing the eclipse from above the clouds from an aeroplane, a Hermes. The original plan, worked out between the pilot, the navigator and Dr. R. L. Waterfield one of the other astronomical guests, was to observe the commencement of totality about 30 miles north of the Shetland Isles, the aeroplane flying down the belt of totality giving an extra 20 seconds for visual observations and photography of the corona.

As the aeroplane approached the agreed region it was found that thick clouds extended far above the level to which the Hermes could rise. The pilot and navigator, however, turned back to where the sky was clear and following a clear lane worked their way to the belt of totality, some 100 miles further east, where the cloud level was only 10,000 feet. At a height of 12,500 feet there was a perfectly clear sky above and a cloud bank below extending to a cloud horizon of about 50 miles. The colour effects on the cloud as totality approached were very striking as also the sunset effects in the distant clear horizon.

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In two respects the shadow differed markedly from the appearance as seen from the ground. Owing to the distance of the horizon the shadow seemed to come up very much more slowly than is the case usually for observations on the ground. It took two minutes or more to move up instead of rushing past. Then as it approached there was a curious ripple effect on the clouds, unlike the shadow bands familiar on the earth's surface. This may have been due to turbulence in the atmosphere above. These ripples preceded the oncoming tide of the shadow itself which was a deep blue colour, variously described as mauve or purple. The colour of the clouds before the shadow reached them was a shade of pale pink mixed with grey. The sky above during totality was of a dark blue colour, such as one sees on a moonlight night. It was too bright for any stars to be seen. Mercury, which was in the field of view, could not be glimpsed; only Venus was seen.

The corona was of the usual minimum type with long equatorial streamers reaching out to two solar diameters and well separated from the polar plumes. The use of polaroid screens showed well the radial polarization of the corona. One or two prominences were visible and towards the end a stretch of rose-red chromosphere was seen along the moon's limb. The inner corona formed a ring around the moon and was so bright that it gave all the appearance of an annular eclipse, until the emergence of the first Baily bead showed the extreme brightness between the sun and the corona. Even so the inner corona remained quite clearly visible for several more seconds. Owing to the height at which the plane, which was pressurized, had to fly to clear the cloud bank, it was impossible to open the windows and photographs had to be taken through glass windows in the cockpit or double perspex windows in the fuselage. The perspex windows gave fewer reflections; both showed well the equatorial extensions of the corona. The whole display was most impressive and memorable and those on the aeroplane, astronomers and laymen alike, owed deep gratitude to those who had made the view possible. The pilot, keeping to his task, was the only person on the aeroplane who saw nothing of the eclipse.

COMMUNICATIONS
FROM THE
DAVID DUNLAP OBSERVATORY
UNIVERSITY OF TORONTO
Number 36

SPECTRAL PECULIARITIES IN CLOSE, LATE-TYPE SPECTROSCOPIC BINARIES

By William R. Hossack

Introduction

An oscilloscopic microphotometer[1] has been employed recently by the author for an investigation[2] into luminosity and spectral type determinations for spectra of late-type stars. In the spectral type investigation, three K-type spectra were discovered which had too-strong hydrogen lines. Their metallic line ratios gave one value for the spectral type, and their hydrogen line ratios a decidely earlier one. The effect could not be accounted for on grounds of different luminosities, and it later turned out that all three were spectroscopic binaries listed in Moore and Neubauer's catalogue.[3]

Two of the binaries were single-lined, the other double-lined. Spectrograms covering the different radial-velocity phases were available for one of the single-lined stars, H.D. 213389; from these the hydrogen lines showed no change in appearance dependent on phase, and the radial velocities for the hydrogen lines did not differ markedly from those for the metallic lines in any way dependent on phase. Also, spectrograms reaching past the H and K lines of calcium into the ultra-violet gave no evidence of a composite spectrum.

Since the evidence indicated a possible correlation between spectroscopic binaries and spectra having too-strong hydrogen lines, the author obtained spectra for many of the late-type spectroscopic binaries listed in the Moore and Neubauer catalogue, in order to examine the strengths of their hydrogen lines relative to the strengths of their metallic ones. Over-exposed spectra were obtained as well as normal ones, where feasible, in order to ascertain whether or not there was present any calcium H and K emission. The dispersion employed was 33 A./mm. at H_γ in most cases. Double-lined binaries were omitted from the investigation

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TABLE I

DATA FOR 23 SPECTROSCOPIC BINARIES LISTED IN THE MOORE AND NEUBAUER CATALOGUE

Star	Period days	Spectrum	Hydrogen Lines	Calcium II Emission	Ecc. e	K km./sec.	a sin i km. 10^6	f(m)	Notes
B.4129	2150	K3 III	Normal	Absent	0.6	16.0	378.4	0.468	
λHya	1586	K0 III	Normal	Weak	0.1	3.7	80.8	0.008	
B.2490	922	K2 III	Normal	Absent	0.3	10.0	121.0	0.083	
B.3649	575	K3 III	Normal	Weak	0.1	11.6	91.3	0.11	
B.4629	478	K4 III	Normal	Absent	0.4	16.1	96.9	0.16	
B.3180	461	K4 III	Normal	Absent	0.2	14.2	89.0	0.133	
B.3673	212	K1 III	Normal	Absent	0.5	18.0	44.0	0.076	
οDra	138	K0 III	*Strong*	*Strong*	0.1	23.5	44.4	0.183	
B.D.+55°2215	109	K0 II-III	*Strong*	*Strong*	0.1	22.1	33.0	0.122	
H.D.99967	75	K1 II-III	*Strong*	Absent	0.0	28.8	29.6	0.185	
B.1	73	K0 III	Normal	Absent	0.3	16.4	15.9	0.030	
H.D.179094	29	K1 III-IV	*Strong*	*Strong*	0.0	40.3	15.8	0.194	
B.5900	25	K1 III	*Strong*	*Strong*	0.0	33.2	11.3	0.094	
H.D.209813	24	K0 III	*Strong*	*Strong*	0.0	33.1	11.1	0.092	
Σ1561 B	24	K3 V	Normal	?	0.4	25.8	7.8	0.034	
λAnd	21	K0 III-IV	*Strong*	*Strong*	0.0	6.6	1.9	0.001	
σGem	20	K1 III	*Strong*	*Strong*	0.0	34.2	9.2	0.081	
ζAnd	18	K2 III	*Strong*	*Strong*	0.0	26.0	6.3	0.032	n
H.D.213389	18	K2 III	*Strong*	*Strong*	0.0	40.2	9.8	0.119	
B.D.+43°2135	13	K5 V	Normal	?	0.1	28.8	5.1	0.032	
B.D.+27°4642	7	K0 V	Weak	*Strong*	0.1	38.5	3.6	0.013	n
B.D.+11°2910	4	K0 V	Normal	?	0.1	38.1	2.2	0.024	
B.4678	3	G8 III	Normal	Absent	0.0	3.6	0.2	0.000	n

ζAnd: This star is variable to the extent of 0.1 magnitude. It may be an eclipsing or an ellipsoidal variable.

B.D.+27°4642: The hydrogen lines are extremely weak in this star. This has little bearing on our discussion however, since it is a singular case.

B.4678: An examination of the orbital elements, combined with a physical consideration of the system, leads the author to believe that the star is not a binary at all.

because of the difficulties involved in their precise classification. Data for the single-lined binaries are given in Table I.

The author, in conjunction with Dr. I. Halliday of the Dominion Observatory, measured 800 spectra on the oscilloscopic microphotometer for a separate programme of Halliday's. These measures yielded four stars not listed in the Moore and Neubauer catalogue whose spectra exhibited the hydrogen-strong effect. These stars, listed in Table II, may be considered to have come from a random sample.

TABLE II

STARS NOT LISTED IN THE MOORE AND NEUBAUER CATALOGUE WHICH EXHIBIT HYDROGEN-STRONG, NON-COMPOSITE SPECTRA

Star	Spectrum	Hydrogen Lines	Calcium II Emission	Radial Velocity
56 Peg	K0 II-III	*Strong*	*Strong*	Variable (Sp. Bin., Wilson catalogue[4])
H.D.49500	K1 III	*Strong*	?	Variable (David Dunlap, unpublished)
H.D.166208	G9 III	*Strong*	Absent	Constant, from 17 plates
α^2 Cap	K0 III	*Strong*	Absent	Constant, from 15 plates

HYDROGEN LINES

(a) *Enhancement in spectroscopic binaries.* It is to be noted that overly strong hydrogen lines occur in most giant-type spectroscopic binaries investigated which have periods less than 140 days and spectral classes later than G8. None of the spectra appears to be composite; neither radial-velocity measures nor microphotometer tracings give any evidence of such a state of affairs.

In no case does a dwarf or long-period giant system exhibit the hydrogen-strong effect.

(b) *Possibility of hydrogen enhancement in single stars.* The first two stars of Table II are probably spectroscopic binaries. Confirmation is still required, however, in both cases. The two constant-velocity cases either could be short-period binaries seen from the directions of the poles of their systems, or they could simply be single stars. One can consider random orientation of binaries having periods, separations, etc. expected to accompany a hydrogen-strong spectrum. The total range in velocity for such a system observed edge-on should be about 80 km./sec., on the average. It is probable that a velocity range greater than 15 km./sec. is detectable for a star as completely observed as either H.D. 166208 or α^2 Cap. The inclination of this limiting case would be $\sin^{-1}$ (15/80), or 11°, and inclinations less than this would be undetectable. The probability that an inclination will lie between 11° and 0° is equal

to the ratio of the area of an 11° spherical cap to the area of the whole hemisphere,[5] or about 1 in 50. Therefore, it seems improbable that both constant-velocity cases of Table II are close binaries.

Since Halliday's sample contained 800 stars, it is certainly safe to say that too-strong hydrogen lines do not occur in many single late-type stars.

(c) *Radial velocities.* Radial velocities of the $H\gamma$ line relative to the metallic lines were measured on about 80 different spectrograms of various hydrogen-strong spectroscopic binaries. Results showed no correlation with phase. The $H\gamma$ line gave, on the average, a velocity of +4 km./sec. referred to the velocity given by the metallic lines. Measures of $H\gamma$ on 40 plates taken at random from our files gave a corresponding average relative velocity of −0.01 km./sec.

It was thought that high-dispersion spectra might provide more information regarding this radial-velocity shift of the $H\gamma$ line. The Mount Wilson and Palomar Observatories kindly supplied the writer with high-dispersion plates of three of the hydrogen-strong binaries (λ And, σ Gem and ζ And) and of two normal stars (ι Cet and λ Hya). The dispersions of the spectra of λ And, σ Gem, ι Cet, and λ Hya were 10A./mm., while that of ζ And was 4.5 A./mm. Microphotometer tracings of the $H\delta$ and $H\gamma$ lines of these spectra are reproduced in figure 1. Rotational broadening of the lines is to be expected for a giant system of short period, and this can easily be seen in the tracings of ζ And and σ Gem. The star λ And, having a smaller velocity range (K), is probably closer to a pole-on binary, thus having less rotational broadening.

From figure 1, it can be seen that the line measured at $H\gamma$ on the David Dunlap Observatory's 33 A./mm. plates is an unresolved blend. It is possible that the rotational effects and the too-strong hydrogen lines could cause a slight shift in the measured wave-length. On the other hand, the wave-length used for measuring the blend at the David Dunlap Observatory does correspond to the true wave-length of the $H\gamma$ line. It may be that the positive velocity effect is a real one, and the hydrogen absorption lines arise, at least partially, from material falling into the star. Measurements of many high-dispersion spectrograms of the binaries might tell whether or not this is the case.

(d) *Intensities.* Intensities of the lines were measured from the traces of figure 1. Depths of the hydrogen lines as compared to metallic ones showed the hydrogen lines to be from 15 to 45 per cent. more intense in the hydrogen-strong spectra than in the spectra of the two normal stars, ι Cet and λ Hya. The rotational broadening in the binary spectra made it difficult to obtain absolute intensities. However, measures of equivalent widths relative to the two normal spectra available showed

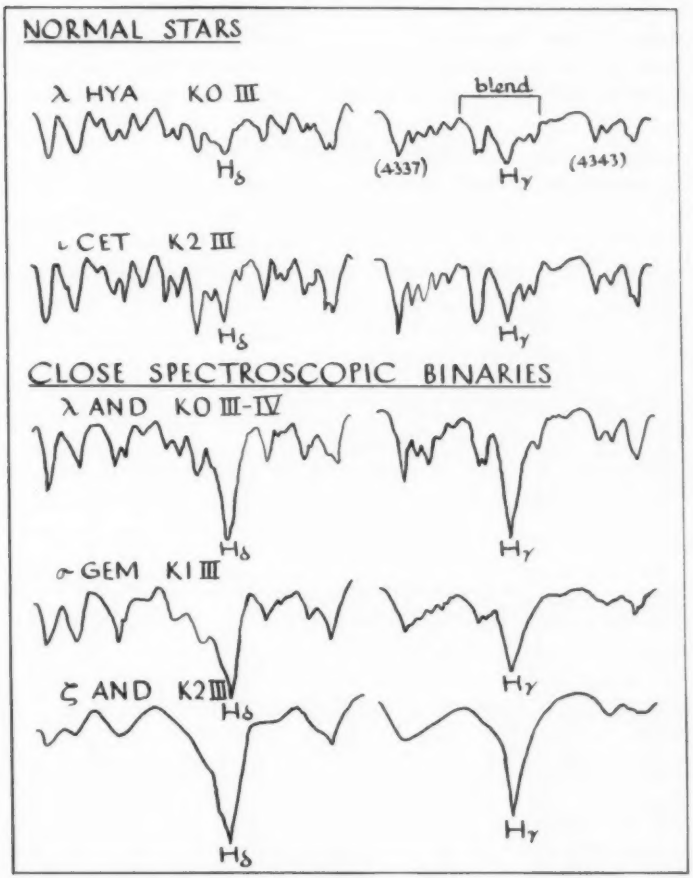

FIG. 1—Microphotometer tracings of the Hδ and Hγ lines in high-dispersion spectra of normal stars and hydrogen-strong binaries. Radial-velocity measures of Hγ on the David Dunlap spectrograms were actually made on the blend shown in the tracing of λ Hya.

the effect to be *probably* due to both a strengthening of the hydrogen lines and a weakening of the metallic ones. These absolute measures should be done more precisely, using many high-dispersion standard spectra, with careful consideration of the rotational broadening effects.

It is possible that the intensity differences are due to a difference in

chemical composition. Current theories suggest that the abundance of hydrogen in the atmospheres of K-type giants is already very great. Another 30 per cent. would result in an abundance high enough to be improbable. The effect probably arises from some other cause.

Calcium Emission Lines

The connection of CaII emission with binary character in late G- and early K-type stars has been established by Struve and Hiltner[6] who have given good reasons for thinking that the emission is limited to two regions near the bulges of tidally distorted stars. The following facts favour their model:

(a) The emission lines occur more strongly in close binaries than in corresponding single late-type stars.

(b) In some eclipsing binaries, the CaII emission exhibits an eclipse effect which is difficult to account for without the hypothesis that it is isolated near the bulges of a distorted star.

Gratton[7] has obtained a correlation between period P and visual absolute magnitude M for binaries showing strong CaII emission. Using

TABLE III

Period-luminosity Data for the Spectroscopic Binaries of Table I Having Periods Less than 140 Days

Star	Spectrum	Peculiarity Class	Period days	log P	π_{tr}	M_{tr}	M_{sp}	M_{ad}
oDra	K0 III	P	138.42	2.14	+.003	−2.8	+0.7	−0.7
B.D.+55°2215	K0 II-III	P	108.57	2.04			−0.9	−0.9
H.D.99967	K1 II-III	PH	74.86	1.87			−0.8	−0.8
B.1	K0 III	N	72.93	1.87	+.009	−0.5	+0.7	+0.4
H.D.179094	K1 III-IV	P	28.59	1.46	+.004	−1.1	+1.3	+0.8
B.5900	K1 III	P	24.65	1.39			+0.8	+0.8
H.D.209813	K0 III	P	24.43	1.39			+0.7	+0.7
Σ1561 B	K3 V	NH	23.54	1.37	+.048	+7.0	+6.6	+6.8
λAnd	K0 III-IV	P	20.52	1.31	+.043	+2.1	+1.4	+1.8
σGem	K1 III	P	19.60	1.29	+.017	+0.4	+0.8	+0.6
ζAnd	K2 III	P	17.77	1.25	+.032	+2.7	+0.9	+1.8
H.D.213389	K2 III	P	17.76	1.25			+0.9	+0.9
B.D.+43°2135	K5 V	NH	12.92	1.11	+.019	+4.8	+7.0	+5.9
B.D.+27°4642	K0 V	PC	6.72	0.83	+.034	+5.0	+5.9	+5.4
B.D.+11°2910	K0 V	NH	4.29	0.63	+.024	+5.4	+5.9	+5.6
B.4678	G8 III	N	3.16	0.50	+.009	+0.2	0.0	+0.1

The spectra are classed as to peculiarities as follows:
N —Normal.
NH—Normal hydrogen lines, but star too faint for convenient examination in the H and K region.
P —CaII emission and too-strong hydrogen lines.
PH —Too-strong hydrogen lines, with no CaII emission.
PC —CaII emission, with normal or weak hydrogen lines.

rough approximations, Gratton employed M as an indication of the radius of the star and P as an indication of the separation. Expecting all stars with tidal distortion larger than a given value to show emission lines, he arrived at the condition that all such stars should lie above the line

$$0.3\,M + \log P = 2.5.$$

One does not expect to find stars much above the limit because the distortion would be too great, resulting in instability. In fact, it may be shown that stars above the line

$$0.3\,M + \log P = 1.0$$

are practically in physical contact.

Table III contains period and luminosity data for the spectroscopic binaries of Table I having periods less than 140 days. The periods of the binaries and any existing trigonometric parallaxes are listed, together with corresponding absolute magnitudes, both trigonometric (where possible) and spectroscopic. The adopted absolute magnitude is the arithmetic mean of the trigonometric and spectroscopic ones where the parallax $\geqslant 0.''015$. In the other cases, the adopted absolute magnitude results from a careful consideration of the spectroscopic absolute magnitude, and the lower limit to absolute magnitude imposed by the trigonometric parallax.

Figure 2 is a plot of M against log P for the stars of Table III, each point representing a star. The filled circles denote stars having peculiar spectra while the open circles denote stars with normal spectra. Two lines representing Gratton's equations $0.3\,M + \log P = 2.5$, and $0.3\,M + \log P = 1.0$ respectively are also plotted. The class of peculiarity as given in Table III is designated for each star. The one point in the region of instability above the line $0.3\,M + \log P = 1.0$ corresponds to the star of Table I, B. 4678, which is probably not a binary at all.

Figure 2 shows all of the binaries with CaII emission to be within Gratton's predicted limits. According to his predictions however, there should be emission in the cases of H.D. 99967 and B. 1, two binaries which also lie within the limits.

All of the binaries having overly strong hydrogen lines fall well within Gratton's limits. As a matter of fact, they all are very close to the line

$$0.3\,M + \log P = 1.7.$$

If the first two stars of Table II are really binaries, it is possible that they too would lie close to this line. In that case their absolute magnitudes, about -1.0 for 56 Peg and $+0.8$ for H.D. 49500, would correspond to periods of about 100, and 30 days respectively.

Why does the tidal distortion cause calcium emission? In his paper,

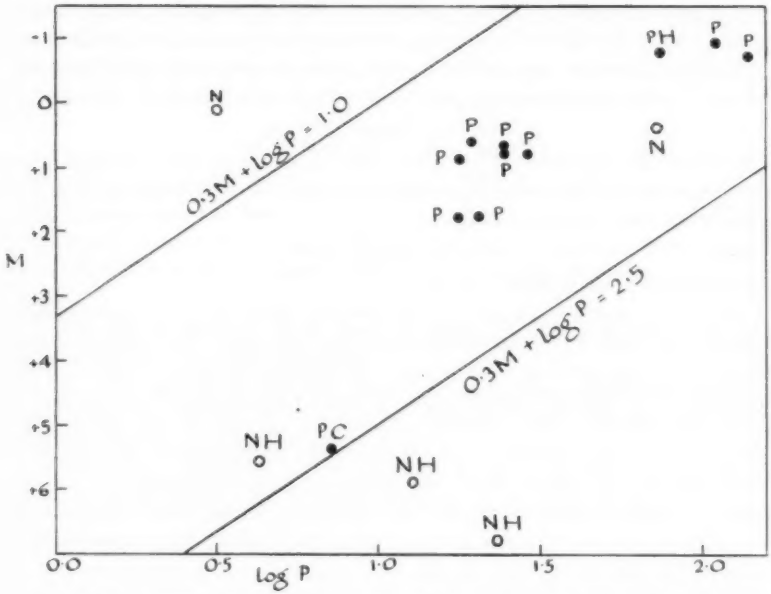

FIG. 2—The correlation between period and luminosity. The closed circles, representing peculiar spectra, are enclosed by the two lines. The open circles represent normal spectra. The classes of peculiarity as given in Table III are marked in.

Gratton discusses in detail the case of ζ And. In this star, a difference in g of 4 per cent. between the tidal bulges and the equatorial direction perpendicular to them yields a velocity of currents in the star near the bulges of the order of $10^{-12}/\rho$ km./sec., ρ being the density of the atmospheric layers. The numerical constant being uncertain by a factor of 10 or even 100, Gratton concludes that the currents thus originated could be large enough to cause the local inversion of the thermal gradient which is required for explaining the emission lines.

Gratton interprets the light variations of ζ And as being due to an eclipse, and finds that the intensity of emission remains nearly constant except when the companion is in front. Spectrograms taken by him at one such eclipse show the emission to be considerably reduced.

Spectograms were taken of ζ And near the centres of two supposed eclipses to examine the emission variation. No large variation was evident either in the CaII emission or the hydrogen absorption lines. The variation noted by Gratton is possibly irregular.

Several plates showing the CaII emission were available for each of the stars H.D. 179094, H.D. 209813 and H.D. 213389. None of the plates shows any variation in emission intensity.

Conclusions

It is probable that both the hydrogen absorption and calcium emission phenomena are connected with streams and currents in the stars, arising because of large tidal forces.

Binaries are of considerable importance in the study of stellar evolution and these spectra therefore warrant further attention. A detailed study of the spectra using high-dispersion spectrograms should be most rewarding. The structures of the hydrogen-absorption and calcium-emission lines could be systematically studied, and it may be that other lines and spectral features would show abnormalities.* A clearer picture of the physical processes involved might then be drawn.

References

1. Hossack, W. R., *R.A.S.C. Jour.*, vol. 47, p. 195, 1953.
2. Hossack, W. R., *Ap. Jour.*, vol. 119, p. 613, 1954.
3. Moore and Neubauer, *Lick Obs. Bull.*, no. 521, 1948.
4. Wilson, R. E., "General Catalogue of Stellar Radial Velocities," *Carnegie Institute Pub.*, no. 601, 1953.
5. Russell, Dugan and Stewart, "Astronomy," vol. 2, p. 701, Ginn and Co., 1938.
6. See Hiltner, *Ap. Jour.*, vol. 106, p. 481, 1947.
7. Gratton, L., *Ap. Jour.*, vol. 111, p. 31, 1950.
8. Roman, N. G., *Ap. Jour.*, vol. 116, p. 122, 1952.

*It may be, for example, that CN is peculiar in many of these binaries. A recent communication from Dr. Philip C. Keenan states that CN seems to be of less than normal intensity in the spectra of o Dra and H.D. 209813. Miss Roman[8] finds the spectrum of γ And to be CN weak, although those of σ Gem and ζ And appear to have normal CN. [*Note added in proof.*]

THE FIRST ASTRONOMICAL OBSERVATORY IN CANADA

By J. E. Kennedy

At the Annual Meeting of the Historic Sites and Monuments Board of Canada, held in Ottawa on June 7th, 1954, the Board unanimously passed a motion to have the observatory at the University of New Brunswick marked with a tablet bearing the following inscription:

First Astronomical Observatory in Canada

Built in 1851 at the instigation of William Brydone Jack, professor of mathematics, natural philosophy and astronomy; President of the University of New Brunswick, 1861–1885. Schooled in the traditions of the Scottish universities, he equipped the observatory with the best instruments of the day. In collaboration with Harvard Observatory he determined the longitude of Fredericton and other places in New Brunswick and corrected errors in the international boundary.

. . . . . .

The motion was presented to the Board by Dr. A. G. Bailey, Dean of the faculty of Arts at the University and New Brunswick representative on the Historic Sites and Monuments Board of Canada.

At present, it is not known when this tablet will be cast. The University has included on a number of occasions, a dedication and unveiling ceremony of similar tablets as part of the Encaenia week observances in May. This may well be the practice followed again, but so far, no decisions have been made in this connection.

Canadian astronomers will be pleased to learn that this historic observatory is to be preserved. It marks the beginning of one phase of the distinguished career of Dr. William Brydone Jack, a pioneer in the field of Canadian astronomy.

Dr. Peter M. Millman of the Dominion Observatory, Ottawa, visited the University of New Brunswick in March, 1954. His impressions of the observatory were published in his weekly column in the Toronto Telegram. Two features that he noted especially were the eight-sided pyramid dome of the observatory and the beautiful mahogany tube on the six-inch refractor telescope. To this might be added the artistic representation of the signs of the Zodiac which within recent years have been painted on the interior walls of the dome.

This historic site in Fredericton will be of great interest to its many visitors. Astronomers, both professional and amateur, may rest assured of a warm welcome to the campus and observatory of the University of New Brunswick.

VARIABLE STAR NOTES

American Association of Variable Star Observers

By MARGARET W. MAYALL, *Recorder*

232848 Z *And.* The variable star Z Andromedae was discovered by Mrs. Fleming, at Harvard Observatory in 1901, from its peculiar spectrum. The spectrum resembled that of Nova Persei 1901 and of Nova (RS) Ophiuchi 1898, and Mrs. Fleming recorded it as "bright lines, nova or variable?" When its photographic light variations were studied, it was found to have had a gradual rise, with fluctuations, from magnitude 12½ in 1887 to 11th magnitude in 1901, then a rapid increase to 9th magnitude at the time of the Harvard Observatory spectrum plate. The star faded, with several intermediate maxima, and remained almost constant at 12th magnitude from 1911 to 1914, when another sudden outburst occurred. The star passed through a similar cycle of fluctuations and had a third burst of activity in 1940, when it reached magnitude 7.8 on the visual scale. Figure 1 is the 10-day mean light curve compiled from A.A.V.S.O. observations since 1922. At the present time Z Andromedae seems to be settling down to about the 11th magnitude.

Z Andromedae is classed as a "nova-like" variable. It has a very interesting composite spectrum formed by a hot blue star superimposed on a cooler red star, which probably influence each other in some way. The semi-periodic outbursts are almost certainly due to the hot blue star. The lines of it almost disappear when the object is at minimum light, and the titanium oxide bands of the red star are then prominent. The colour index, according to Mrs. Naomi Greenstein (H.B. 906, 1937) fluctuates between +0.6 and +1.4 and increases as the star grows fainter. The variable becomes definitely bluer as it reaches maximum, and redder when it is at minimum.

Figure 2 shows the complete light curve of Z Andromedae from 1887 to the present time. The figure shows a strong indication of a periodicity in the vicinity of 20 years. The interesting question is, "Will the next three or four years produce another 8th magnitude outburst?"

171333 *u Her.* The star u Herculis is an extremely interesting eclipsing star with a period of about two days, which shows signs of changing. Accurate times of minima are needed. Our member, John J. Ruiz, has adopted it as one of his programme stars for his photoelectric photometer. He sent his observations to Dr. Bradshaw Wood of the University of Pennsylvania, who acts as a clearing-house for all eclipsing variable work. Dr. Wood has turned Mr. Ruiz's observations over to Mr. S. N. Svolopoulos, one of our A.A.V.S.O. observers from Greece, who has been making a special study of u Herculis at the University. Mr. Ruiz writes that during August he secured 12 yards of tracings of u Herculis, corresponding to about 14 hours of observing. He also had six hours of observing during June, and 10 during July on the same variable.

In the *Bulletin of the Astronomical Institute of the Netherlands,* Volume XII, Number 449, 1953, C. de Jager has an article on the variation of the β Canis Majoris star DD Lacertae. In his study of the star, he combined his observations made at

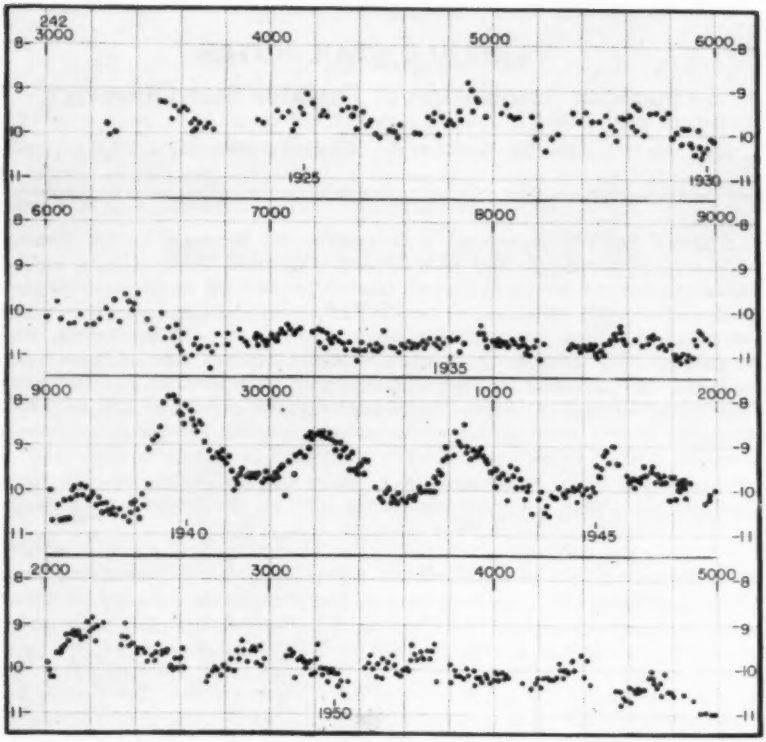

FIG. 1—232848 Z And. Light curve from A.A.V.S.O. observations, 1922–1954.

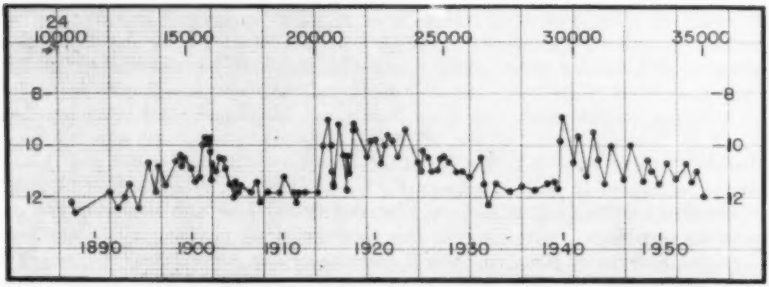

FIG. 2—Light curve of Z And from 1887 to 1954.

the Utrecht Observatory with those made by Miss Nekrasova in Russia and by Mr. Ruiz in Dannemora, New York (*R.A.S.C. Jour.*, vol. 46, p. 203, 1952). Mr. de Jager wrote: "By this totally accidental and unprepared collaboration between three observers at different longitudes on earth, the star was observed simultaneously by two observers on some days; in two cases the star was held under control during 12 and 14 hours consecutively." From the combined observations, he determined a new value of the primary period and discovered a hitherto unknown secondary variation. He concludes that it is very probable that DD Lacertae is a pulsating star, and suggests the possibility of an equatorial and a polar pulsation to account for the two components.

Observations received in July and August, 1954. During July, 52 observers contributed 3,524 observations, and in August 47 observers sent in 4,342, a total of 7,866 for the two months.

Observer	July		August		Observer	July		August	
	No. Var.	No. Ests.	No. Var.	No. Ests.		No. Var.	No. Ests.	No. Var.	No. Ests.
Abbey, Leonard B., Jr.	8	13	12	12	Kelly, Frank J.	...	...	14	31
Adams, Robert M.	66	172	69	192	de Kock, Reginald P.	144	495	144	650
Ancarani, Mario	16	17	25	52	Kuzian, James	7	7	...	...
Anderson, Curtis E.	155	300	181	404	Lacchini, Giovanni B.	27	39	45	140
Aronowitz, Charles	87	406	101	465	Lonak, Eugene	2	8	2	11
Beidler, Herbert B.	30	47	24	50	Maran, Stephen	47	207	70	242
Blunck, Victor H.	3	8	...	...	McPherson, Charles	12	19	13	18
Boutell, Hugh G.	9	35	9	41	Miller, William A.	8	9	45	50
Buckstaff, Ralph N.	18	30	15	60	Montague, Allen C.	50	76	55	73
Carpenter, Claude B.	...	...	46	48	Oravec, Edward G.	99	340	101	384
Charles, Donald F.	11	23	...	...	O'Sullivan, William H.	5	9	...	...
Chester, Arthur	22	71	...	...	Parker, P. O.	30	30	22	22
Cragg, Thomas A.	140	144	43	44	Parko, Joseph E., Jr.	4	4	...	...
Darsenius, Gunnar	5	5	12	12	Pearcy, Robert E.	5	5	...	...
Diedrich, DeLorne	1	1	7	9	Peltier, Leslie C.	22	133	16	89
Diedrich, George	3	15	10	16	Perry, Wendell L.	9	10	6	6
Elias, Demetrius P.	65	232	...	...	Renner, C. J.	...	...	182	292
Erpenstein, Oscar M.	2	2	5	10	Rick, Louis	2	4	2	4
Fernald, Cyrus F.	21	36	119	177	Rizzo, Patrick V.	36	62	25	49
Ficonetti, Rene	...	...	10	14	Rosebrugh, David W.	12	36	10	75
Ford, Clinton B.	25	26	81	81	Royer, Ronald	...	...	15	19
Gaustad, John E.	...	...	7	7	Schultz, Gerald W.	1	4	1	6
Goodsell, J. G.	6	6	5	5	Skaritka, Paul	23	30	15	15
Hales, LaVaughn	...	...	3	5	Thurn, Vincent W.	...	...	8	21
Hartmann, Ferdinand	106	107	89	92	Walko, Kenneth	1	1	...	...
Hein, George	18	75	47	236	Walsh, John F.	2	2	1	3
Herring, Alika K.	1	2	...	...	Watson, Paul S.	...	...	21	34
Jackiw, Roman W.	3	3	...	...	Wyckoff, Jerome	22	41	19	33
Juarez, Angel	27	27	12	12	Yamada, Tatsuo	18	39	...	...
Kastin, Harold	36	98	20	31	Zimmerman, W. W.	4	4	...	...
Kelley, Leo A.	9	9	...	...					

Nova Search Programme: Eight observers contributed reports during July and August. Listed for each observer is the month the observations were received, the areas observed (in italics), the number of nights the region was checked, and finally, the limiting magnitude.

BLUNCK, VICTOR H., July–*8*, 9, *10*: 5, 6.

DARSENIUS, GUNNAR O., August–*16*, *17*: 2, 5.

DIEDRICH, DELORNE, July–*94*: 1, 5; August–*40*: 1, 6.

DIEDRICH, GEORGE, July–*Dome*: 4, 2; *78*: 3, 6; *78*: 3, 5; *56*: 1, 5; August–*Dome*: 4, 2; *78*: 6, 6.

DIEDRICH, PAUL O. H., August–*77*: 1, 4.

RICK, LOUIS, July–*Dome*: 4, 2; *18*: 3, 4; *63*: 3, 5; *63*: 1, 4; August–*Dome*: 9, 2; *18*: 7, 5; *18*: 2, 4; *63*: 8, 5; *63*: 1, 4.

ROSEBRUGH, DAVID W., July–*Dome*: 2, 3; *Dome*: 2, 2; *1*: 1, 4; August–*Dome*: 5, 3; *Dome*: 2, 2; *1*: 5, 4; *1*, *34*: 1, 3.

WELLS, KARL A., July–*1*–*22*: 4, 6.

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September 1954

METEOR NEWS

By Peter M. Millman, *Dominion Observatory, Ottawa*

Photographic Meteor Spectra (Appendix 2)

As in previous years I have listed here all new photographic meteor spectra of which I have knowledge. The listing is up to the end of 1953 and if any readers of the Journal know of additional spectra which I have missed I would very much appreciate being informed of them.

The form of the Table follows those published previously in the Journal—vol. 46, p. 121, 1952; and vol. 47, p. 217, 1953. The serial reference number appears in the first column. The asterisk is used to indicate mid-exposure time in cases where no visual observation was made.

Spectrum No. 134 was photographed by the Harvard Meteor Expedition in New Mexico. Numbers 135 to 139 were secured in the course of the photographic meteor programme carried out by the Dominion Observatory. Reproductions of No. 137, a panchromatic spectrum, and No. 138, an infra-red spectrum, have appeared in *Nature*, reference 25. Spectrum No. 140 was photographed with five different cameras in all. The photography was carried out by Professor J. A. Russell and Dr. G. Reaves of the Department of Astronomy, University of Southern California; and also by Mr. and Mrs. M. Sadoski at the Brackett Observatory, Pomona College, Claremont, Calif.

Reference

25. Millman, P. M., *Nature*, vol. 172, p. 853, 1953.

LIST OF PHOTOGRAPHIC METEOR SPECTRA (APPENDIX 2)

No.	Date			G.C.T.			Shower	Location (Observatory)	Ref.
	y	m	d	h	m	s			
134	1953	7	6	4	20	*		Soledad, N.M. (H.C.O.)	
135		8	12	3	20	50	P	Metcalfe Rd., Ont. (D.O.)	
136		8	12	7	03	56	P	" " " "	
137		8	12	7	34	51	P	" " " "	25
138		8	14	7	20	13	P	" " " "	25
139		8	16	6	58	30		Meanook, Alta. (D.O.)	
140		12	13	7	54	30	G	Juniper Hills, Calif. (U.S.C.)	

Meteor Showers and Rainfall

A paper by E. G. Bowen entitled "The Influence of Meteoric Dust on Rainfall"[1] has caused a considerable amount of comment, particularly in the science columns of the daily press and news magazines. In this paper Bowen presents evidence for a correlation between the dates of the better known meteor showers and the average daily rainfall. He finds that, in general, daily rainfall is heavy about 29 or 30 days after the maximum of a meteor shower.

Only a part of the statistical material on which the conclusions of the paper were based was reproduced in the reference quoted. Some additional rainfall graphs appeared in a review in the columns of the *Christian Science Monitor* dated Feb. 5, 1954. From the examination of these I was not entirely convinced of the statistical significance of the daily rainfall peaks in January that had been correlated with the Geminid, Ursid and Quadrantid meteor showers, but I am not familiar enough with the reduction of rainfall data to make my opinion on this point worth very much.

I did feel, however, that certain basic astronomical features of the meteor showers had been disregarded in Bowen's paper. One should not take a bare list of the dates of the maxima of ten meteor showers and use this without adequate consideration of the differing characteristics of these showers. For example, on page 493 of Bowen's paper the general statement is made that when the earth passes through a meteor shower the normal hourly number of meteors can increase from 10–12 to upwards of 50–60. Out of the ten night-time showers referred to this ratio of increase is true only for the Perseids and Geminids. As will be noted from the table of meteor showers published in the last issue of the Journal[2] the Quadrantid shower may raise the normal hourly rate from 7 to 35 but this is for a few hours only. If we spread the influence of this shower over two days, a reasonable period in view of the spread of Bowen's rainfall peaks (page 492, figure 3), we find that the Quadrantids increase the average non-shower rate of 7 up to only 9 or 10. In fact, taking the eight major night-time showers apart from the Perseids and Geminids, and computing their average yearly effect for the 48 hours nearest the time of each maximum, we find that the sporadic rate of 7 is raised to 12 only.

Another consideration is of importance here. The rates quoted above refer to visual meteors. Considerable evidence has now been secured that the faint radio and telescopic meteors do not increase in the same ratio at the periods of the meteor showers. In other words the arrival of the smaller meteoric dust particles is much more uniform from day to day. Yet this is the type of material which will have the greatest effect

in producing rain, and the daily contribution by weight to the earth's atmosphere is much greater for the small particles.[3]

Bowen uses the three showers, Geminids, Ursids and Quadrantids, and couples them with rainfall peaks near Jan. 13, 23 and 31 respectively. The rainfall data are taken from Durban (30° S.), Perth (32° S.), Alice Springs (24° S.), Brisbane (27° S.), Sydney (34° S.), Auckland (37° S.), Christchurch (44° S.), and Great Britain (50°–56° N.). The Ursid radiant is at declination +80°, so none of these meteors will enter the earth's atmosphere south of 10° S. latitude and relatively few for 10 to 15 degrees north of this. The Quadrantid radiant is at +50° so no Quadrantids will appear south of latitude 40° S. and very few will be visible in the zone 25°–40° S. The Geminids with a radiant at +32° will be visible at all the southern stations listed but not in anything like the numbers seen in the northern hemisphere. Hence two of the three showers listed will have little or no initial effect on the atmosphere south of the equator and to rationalize any connection with the rainfall peaks one must assume a widespread and rapid north-south circulation of the upper atmosphere across the equator. I understand from the meteorologists that there is little evidence for this as yet.

Another difficulty is that most meteor showers last for some time and will contribute dust of various sizes to the upper atmosphere. The rate of settling from the 100-km. level for this dust will vary greatly with size, as Bowen himself points out on page 494, and it is difficult to see how, under these circumstances, relatively sharp rainfall peaks can be produced.

It is possible that in the future a connection will be found between rainfall and some of the really great meteor showers, but in the evidence presented to date on this subject I feel that the astronomical and geophysical difficulties have not been given adequate consideration.

References

1. E. G. Bowen, *Australian Jour. of Physics*, vol. 6, p. 490, 1953.
2. P. M. Millman, *R.A.S.C. Jour.*, vol. 48, p. 193, 1954.
3. P. M. Millman, *R.A.S.C. Jour.*, vol. 46, p. 79, 1952.

NOTES AND QUERIES

On the Density of a Hypothetical Lunar Atmosphere

It is generally believed that the moon does not have an atmosphere at all. The fact that an occulting star vanishes behind the lunar disk instantly is accepted as a proof for the non-existence of a gaseous envelope on the moon.

On the other hand there are phenomena which may indicate the presence of an atmosphere. Although we have never observed a formation of clouds on the moon, occasionally local disturbances of the surface are observed. They are interpreted as a change of transparency of the atmosphere. A remarkable phenomenon was observed by a number of astronomers during occultation of Jupiter on August 7, 1889. At the egress of this planet a strip of shadow covered the disk extending one-fifth of its diameter. This did not change for about a minute. The satellites of Jupiter were observed with diminished intensity in the region of the shadow. One explanation of the shadow is that it was caused by a lunar atmosphere.

An attempt to determine the density of a lunar atmosphere was made recently by J. N. Lipskij at the Astronomical Institute of Moscow. (*Trudy*, vol. 22, p. 66, 1953). It is obvious that any atmosphere will reveal itself by scattering the light of sun. This scattered light will be polarized. A maximum of polarization is obtained near the first or last quarter of the moon. From the observed polarization, however, that caused by the scattering in our atmosphere has to be subtracted.

From theoretical considerations it is possible to find a relation between the number of molecules above a unit of lunar surface and the amount of light scattered by the atmosphere. This last was determined from observations. Photographic and visual observations by means of a polaroid filter by the author have shown that the mass of the lunar atmosphere is at least 1/2000 of the terrestrial, provided they have the same chemical composition. The pressure of this supposed atmosphere corresponds to a pressure of 0.06 mm. of mercury, which on the earth is found at a height of about 45 miles.

G. A. B.

A New Radio Telescope for Australia

It has recently been announced that a grant of $250,000 has been awarded by the Carnegie Corporation of New York to aid in paying part of the cost of building a giant radio telescope in Australia. The money will be administered by the Commonwealth Scientific and Industrial Organization. The most obvious part of the instrument will be the "dish", a vast grid of metal strips 250 feet in diameter and about 60 feet deep. The flexible mounting will allow the telescope to be pointed at any section of the sky. The construction of the telescope is expected to take about three years. Scientists will use the new telescope to explore the heavens visible from the southern hemisphere, particularly the Magellanic Clouds. The work done in Australia will complement radio-wave observations obtained at Manchester, England. This new tool will be in the hands of enthusiastic workers who have already given many significant contributions in the comparatively new field of radio astronomy.

B. R. G.

Office of Naval Research Astronomy Programme

Astronomical research at many institutions in the United States during the past half-dozen years has been greatly advanced by substantial grants from the United States Government Office of Naval Research. It has been gratifying to many astronomers to have the importance of astronomy recognized in this way by government aid. Now that the National Science Foundation has been established, with its support of astronomical research and education (this Journal, vol. 48, p. 134, 1954), the problems which will be encouraged by the Office of Naval Research have been adjusted to avoid duplication; the two programmes will be co-ordinated. Examples of the types of problems of interest to the Navy are: celestial mechanics in the solar system, astro-ballistics, solar-terrestrial relationships, upper atmosphere research, navigation, position finding, improvement of techniques and instrumentation, astro-gas dynamics and radio astronomy.

An Advisory Committee of astronomers has been nominated by the American Astronomical Society for a three-year term, to help in evaluating the proposals submitted. The members of this committee are: N. U. Mayall of the Lick Observatory, Chairman, O. C. Wilson, B. J. Bok, J. J. Nassau, G. M. Clemence, A. B. Meinel and K. A. Strand.

R. J. N.

Distances of Radio Stars

The existence of a large number of discrete sources of extra-terrestrial radio radiation (radio stars) has now been established. For the majority, there exists no information about distance; only a few have been identified with celestial objects observed photographically. Experiments carried on to measure radio parallaxes of the sources have failed to measure any actual parallax, thereby establishing only that the radio stars are distant from us more than half a parsec.

D. R. W. Williams and R. D. Davies of Jodrell Bank have recently employed a new method for distance determination. The method depends upon the absorption of the radiation from the radio stars by interstellar hydrogen at a frequency corresponding to the spectral line of the ground-state of the neutral hydrogen atom. If the radiation from the source traverses neutral hydrogen in the galaxy, it will suffer absorption at the line frequency, whereas its emission at neighbouring frequencies will be unaffected. The total amount of absorption will depend upon the amount of neutral hydrogen traversed. Since the neutral hydrogen occurs in the arms of the galaxy and the associated velocities are different for the two arms, the measured frequencies of the absorption for the arms will be slightly different. The absorption from the two arms will be measured separately.

Williams and Davies find radiation from the Cygnus source to be absorbed in both arms of the galaxy. The absorption is of the order of that to be expected for the two arms. The source is therefore somewhere past the second arm, or at a distance greater than 9,500 parsecs. Radiation from the Cassiopeia source is not absorbed at all in the outer arm and probably only partially in the inner one. The radio star lies either in the inner arm or between the two arms. Its distance is probably between 500 and 2,500 parsecs.

W. R. H.

NOTES FROM OBSERVATORIES

DOMINION ASTROPHYSICAL OBSERVATORY, VICTORIA, B.C.

Preparations for Observing the 1954 Total Solar Eclipse at Hansen, Ontario

The expedition from the Dominion Astrophysical Observatory to observe the total eclipse of the sun on June 30, 1954 was located at Hansen, Ontario, on the Algoma Central and Hudson Bay Railroad, 34 miles south of Hearst, on property of the Northern Paper Mills Ltd., the position of the eclipse site being $\lambda = 84^\circ\ 01'\ 10''$ W., $\phi = +49^\circ\ 17'\ 40''$.

The personnel of the party included Mr. John Galt, from the Department of Physics of the University of Toronto, Mr. P. E. Argyle and the author, who arrived on June 3; and Dr. Jean K. McDonald, who arrived on June 25.

As the Meteorological Service of Canada had indicated that the probability of obtaining clear skies on the day of the eclipse along the line of totality in northern Ontario was somewhat less than one-third, it was decided to concentrate on a single instrument, a slitless spectrograph, to study the photographic region of the flash spectrum. The grating with 15,000 lines/inch and lens of 72 inches focal length gave a dispersion of 4.2 A./mm. with an excellent field from λ3550 to λ4600 on a twelve-inch plate. The eclipse spectrograph was built at Victoria by A. Salonen from designs prepared by S. S. Girling.

The principal innovation in the design of the instrument was the mechanism for moving the plate rapidly between exposures. At the 1936 and 1940 eclipses, R. O. Redman[1] employed a Geneva gear to give a discontinuous motion to the plate when a handle was rotated at a uniform speed, and he generously provided photographs of his design. In the present case, P. E. Argyle suggested that it might be possible to move the plate more rapidly and thus to obtain more exposures of the flash spectrum by modifying Redman's design. Details for this modification were worked out by Girling. The completed mechanism, shown in figure 1, consisted of two sixty-degree Geneva gears linked together in such a way that in a one-second cycle, the plate was stationary for $\frac{9}{10}$ second and moved for $\frac{1}{10}$ second. A cam, to which a shutter was

[1] *M.N.*, vol. 97, p. 668, 1937; vol. 102, p. 134, 1942.

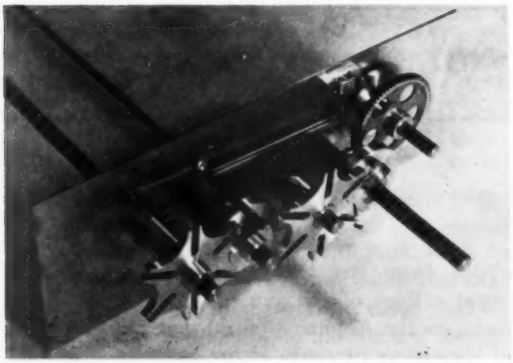

FIG. 1—Geneva link-work mechanism prepared for eclipse spectrograph to permit rapid change of plate position.

attached immediately in front of the photographic plate, was also included in the mechanism in order to provide two exposures at each setting, one-half of the flash arcs to receive the full 0.9-second exposure and the other half only 0.1 second. Thus it was hoped to obtain suitable densities for both the continuous spectrum and the emission lines, and also to make some allowance for the uncertainty in the optimum length of exposure required to photograph the flash spectrum with this instrument. There is still a great uncertainty concerning the correct exposure time for flash spectra. It seems probable that, with modern gratings which concentrate most of the light in one region of the spectrum, slitless flash spectra of suitable density should be obtained on fast emulsions with exposures of less than one second, but a 0.9-second exposure was chosen for the Hansen site because the ultra-violet region of the spectrum was to be studied, and because a large amount of absorption would be produced by the terrestrial atmosphere at the low altitude of the sun (13°) at the time of eclipse.

The equipment as set up on June 23, is shown in figure 2. During tests, the 6-inch reflector-collimator was placed between the coelostat mirror and the end of the spectrograph as shown, but it was removed at the time of the eclipse since the arc of the chromosphere acted as a slit. The reflector was used not only in connection with the focusing of the spectrograph, but also in photographing slit spectra of the sun at various zenith distances to determine the absorption in our atmosphere, and in impressing the photometric calibrations on the photographic plates by means of a standardized quartz lamp and a step slit. Accurate timing of

FIG. 2—The Eclipse Site at Hansen, Ontario, June 23, 1954. *Left to right*: K. O. Wright and John A. Galt. The instruments include: A. Coelostat mirror; B. Theodolite (used as guiding eyepiece); C. Coelostat clock; D. Spectrograph; E. Plate-moving mechanism (attached to motor); F. Chronograph; G. Radio; H. 6-inch Reflector (used as collimating tube).

the exposures was obtained from electrical contacts on the plate-moving mechanism and on the chronometer, both of which actuated pens on the chronograph. A guiding device was obtained by reflecting the light from the zero-order of the grating back to the telescope of a theodolite, which was placed beside the coelostat. The observer could then make small adjustments to the position of the image of the sun as required. An eyepiece was also inserted in the far side of the spectrograph in order that the region of the solar spectrum near $H\alpha$ in the first order of the grating could be observed.

The weather during the month of June was variable but, on the whole, better than had been expected. Of the 29 days in June 1954 when the sky was observed at the time predicted for the eclipse, observations could have been made, at least in part, on thirteen. The three days before the eclipse were fair and all last-minute preparations were completed. On

the night before the eclipse the sky was clear and the final focus tests of collimator and spectrograph were made on schedule. However, when the morning of June 30 arrived, the sky was completely overcast (as the forecasters had predicted), and at the time of the eclipse it was raining lightly. The rapid darkening of the sky at the time of second contact was most marked, as was the increase in brightness following third contact. The general impression among the observers was that third contact came slightly earlier than had been computed, but no measures were recorded to test this point.

General conditions at Hansen, with the exception of the black flies and mosquitoes, were excellent. Thanks are due to Northern Paper Mills Ltd. and particularly to Mr. H. Hicks, woods superintendent at Hansen, and to all his staff for their co-operation and help. The final satisfactory adjustment of the spectrograph was achieved only after many improvisations by Mr. Galt, and the timing and electrical connections were the work of Mr. Argyle. The Dominion Astronomer, Dr. C. S. Beals, visited the camp on June 16, and Dr. L. Locke assisted in many ways, not only in selecting the site, but also in obtaining equipment during the months of preparation. The coelostat, which was such a vital part of the equipment, was kindly loaned by the Superintendent of the U.S. Naval Observatory, and the standard lamp to be used for the photometric calibrations, by the Department of Physics of the University of Toronto.

K. O. Wright

Solar Eclipse

The ground party from the Dominion Observatory to observe the total eclipse of the sun of June 30 was located at Smoky Falls, Ontario, close to the central line and some 50 miles north of Kapuskasing. Transportation and accommodation for the party were provided through the co-operation of the Spruce Falls Power and Paper Company who operate a hydro-electric generating station at Smoky Falls. The party was in charge of Dr. J. L. Locke, and the other observers were Dr. R. V. Karandikar, Dr. J. A. Rottenberg, Dr. I. Halliday, Mr. L. Miller and Dr. C. S. Beals. Mr. C. O'Neil and Mr. E. Sanders had assisted at the site during the early stages of construction. A large slit spectrograph and two interferometric cameras were installed for the purpose of determining the widths and contours of the chromospheric emission lines at second and third contacts. The slit spectrograph was essentially the solar spectrograph of the observatory, rebuilt at the site and equipped with a plate motion device and shutter to enable exposures to be taken at the rate of one every two seconds.

This spectrograph has camera and collimator mirrors of 20-ft. focal length and with the 14,400 lines/inch grating used in the third order gave a dispersion of about 1A./mm. The solar image was formed at the slit of the spectrograph by a 6-inch mirror of 20-ft. focal length fed by a coelostat mirror.

The interferometric cameras consisted of fast slitless spectrographs crossed with Fabry-Perot etalons. These employed transmission gratings having 10,000 lines/inch and F/2.9 cameras with automatic film transport, enabling spectra to be taken at the rate of one a second. In one instrument the separation of the aluminized etalon plates was one mm. and in the other three mm.

Although the ground party was completely clouded out, the airborne expedition, a combined effort of the Dominion Observatory and the National Research Council, carried out its programme successfully. Observations were made from a North Star aircraft flown by the Royal Canadian Air Force. Slit spectra of the flash were obtained with a Hilger medium quartz spectrograph fitted with a film magazine and rapid film transport mechanism. Spectra of the corona were obtained with a quartz spectrograph of aperture ratio F/4. Visual observations of the corona were made for transmission by radio to Swedish astronomers and a search was made for daytime aurorae. The observations were taken at a position near 58 degrees north latitude, 61 degrees west longitude, at an altitude of 27,500 feet above sea level. A more detailed account of this expedition will appear in a subsequent issue of this JOURNAL.

REVIEW OF PUBLICATIONS

Celestial Mechanics by W. M. Smart. Pages viii plus 381; 6½ × 10 in. Toronto, Longmans Green and Co., 1953. Price $12.60.

Volume d'impression soignée et dans une langue claire. Après un bref rappel des conventions et des définitions élémentaires l'auteur nous présente un exposé de la mécanique céleste classique: exposition du problème général de *n* corps, équation et méthode de résolution des équations de Lagrange, les équations canoniques de Hamilton, les transformations de contact, les méthodes suivies par Adams et Le Verrier pour arriver à la découverte de Neptune, les théories lunaires de de Pontécoulant et de Hill-Brown et finalement une étude de la précession et de la nutation.

GHISLAIN ROY

This is a carefully prepared book written in a comprehensible style. After a short explanation of fundamental principles and of elementary definitions the author presents a theory of classical celestial mechanics, i.e. the theory of a general problem of *n* bodies, Lagrange's equations and the method of solution of Lagrange's equations, the canonical equations of Hamilton, the contact transformations, the methods followed by Adams and Le Verrier which led to the discovery of Neptune, de Pontécoulant's and Hill-Brown's lunar theory and finally a chapter on precision and nutation.

Rocket Exploration of the Upper Atmosphere edited by R. L. F. Boyd and M. J. Seaton, in consultation with H. S. W. Massey. Pages viii plus 376; 7¼ × 9¾ in. London, England, The Pergamon Press Ltd., 1954. Price £:3.15.0.

The possibility of direct observation of the properties of the upper atmosphere by transporting measuring equipment in rocket vehicles was opened by the remarkable development of rocket engineering which occurred during the war, largely in Germany. Since the war, atmospheric physicists in the United States have carried on a very fruitful programme of research using both the German V-2 rockets and newer, American-designed rockets.

This book is a summary of all this recent work, being a report of the first major international scientific conference concerned with rocket exploration of the earth's upper atmosphere—a conference arranged by

the Upper Atmosphere Rocket Research Panel of the United States and the Gassiot Committee of the Royal Society of London.

The book includes up-to-date accounts of the following problems: techniques used in rocket exploration; pressures, temperatures and winds in the high atmosphere; the composition of the atmosphere; the structure of the ionosphere; solar ultra-violet radiations; geo-magnetic variations; cosmic rays; related laboratory studies; the theoretical interpretation of results and suggestions for further experiments.

Research scientists will find the book invaluable. References are included and the presentation of the material is excellent.

The subject matter is fascinating. Every section has astronomical significance. This reviewer has no qualms about recommending the book to any reader with a good astronomical appetite.

W. R. H.

Astrophysics—Nuclear Transformations, Stellar Interiors, and Nebulae by L. H. Aller. Pages x plus 291; 6¼ × 9¼ in. New York, The Ronald Press Company, 1954. Price $12.00.

This volume is a companion to the excellent text-book which was published a year ago by the same author. The previous volume dealt with the atmospheres of the stars; this one treats most of the remaining fields of astrophysics. The first three chapters are devoted to various problems related to the internal structure of the stars. Included are discussions of the nuclear processes which are important in the central regions of stars, models for the sun, giant stars, and white dwarfs, and the problems of pulsating stars. The following two chapters are devoted to studies of peculiar stars such as Be stars, Wolf-Rayet stars, novae and supernovae and of planetary nebulae. The final chapter surveys the present knowledge of the interstellar medium.

One of the most attractive features of the book is that it is completely up-to-date. The author includes, for example, the recent work on stellar evolution, the identification of some of the radio stars, and galactic magnetic fields. Astronomy students will therefore find this book very valuable as an introduction to modern astronomical research.

As in the first volume, the author has many illustrative practical problems both in the text and at the end of each chapter. The references have been very carefully selected and are arranged so that they will be of maximum value.

J. B. O.

MEETINGS OF THE SOCIETY

AT MONTREAL

June 30, 1954—Operation Eclipse. (Summary.)

Definite plans to view the total eclipse of the sun from Mattice, Ontario, were made some three months before the event. A sleeping car was chartered, to be placed on a siding at Mattice, and there used as headquarters.

The party leaving Montreal on the evening of June 27 were: G. Harper Hall, C. M. Good, Miss I. K. Williamson, Mrs. D. Zorgo, Miss R. Jamieson, Miss L. Wilson, C. Cox, E. E. Bridgen, A. L. Burran, B. Cockhill, M. Fortier, B. Jones, G. Menard, B. Muhlstock, C. E. Warner and D. Zackon. Miss K. S. Pearce of Princeton, N.J., and P. W. Witherell of Boston, Mass., were also in the party. At Ottawa four members of that centre joined the group: Miss M. Rettie, Miss J. Stewart, Bill Gault and S. A. Mott. The car arrived at Mattice at 8:44 p.m. E.S.T. Monday in bright daylight. At Mattice others who joined the party were Mr. and Mrs. DeKinder, Director of Observations for the Montreal Centre, L. A. Cotton of Vancouver, B.C., F. T. Matthews and W. Creighton of Port Arthur.

The site chosen for the observations was on an abandoned farm, some 500 yards from the station. The point at which the rising sun appeared was checked, so that in arranging positions for instruments, obstructions might be avoided. A radio was set up for the reception of time signals. All instruments and programmes were checked.

On Tuesday evening Mr. Good set up his 4-inch telescope and some 200 people were able to observe the planets Venus, Saturn and Mars.

On the morning of Wednesday, June 30, the entire party was up at 4:30 a.m. as arranged. The sky was completely covered by clouds, but all equipment was taken to the observing site and set up in position. The following observations were made until after fourth contact at 8:20 a.m.: radio signals, light intensity, temperature, wind velocity and direction, and barometric pressure.

The eclipse had not been seen, but all had been aware of the odds against it. A spirit of satisfaction prevailed, in that each one had carried out or been ready to carry out, that part of the programme of observation to which he had been assigned.

The car remained at Mattice until 8:15 a.m. July 1, stopping in Ottawa the next morning. Plans were made to exchange photographs with the Ottawa members of the party; it is also hoped that visits between the centres can be arranged. All members of the party plan to re-assemble in 1963 for the next eclipse visible in eastern North America.

E. E. Bridgen, *Recorder.*

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THE JOURNAL
OF
THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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PUBLISHED BI-MONTHLY
(*Six numbers per year*)

VOLUME XLVIII, 1954

PRINTED FOR THE SOCIETY

TORONTO: 13 ROSS ST.

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THE JOURNAL
OF
THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

VOL. XLVIII, No. 6 · NOVEMBER-DECEMBER 1954 WHOLE No. 411

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Address of Editors: David Dunlap Observatory, Richmond Hill, Ont.

Business correspondence and remittances should be addressed to J. H. Horning, Treasurer of the Society, 13 Ross Street, Toronto 2B.
$3.00 per annum, Single number, 50 cents.
Subscription to the JOURNAL is included in membership fee.

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